

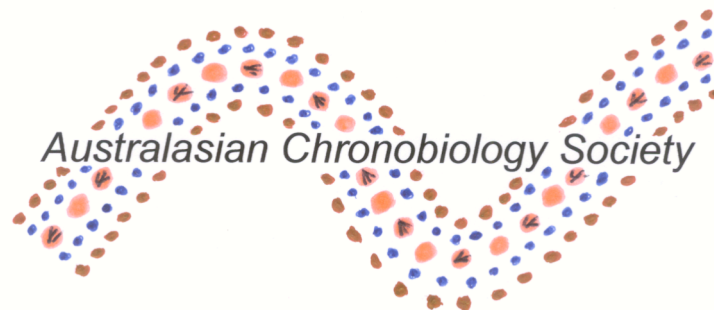
Living in a 24/7 World:

The impact of circadian disruption on sleep, work and health

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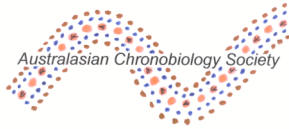
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Chapter 1

“The nature of the beast”: Metropolitan train drivers’ experience, perception and recognition of fatigue

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Aims: Research on fatigue and train driving is characterised by the objective measurement and evaluation of workload and fatigue. Drivers’ ability to individually recognise fatigue *in situ* is equally important. The aims of this paper are to outline the ways in which metropolitan rail drivers in an Australian capital city subjectively experience, perceive and recognise fatigue whilst they are driving.

Methods: The present study employed a mixed-methods approach. It involved a closed-ended survey completed by 124 drivers that was contextualised through ethnographic focus groups and in-cab interviews involving a total of 48 train drivers.

Results: Over three quarters of drivers reported experiencing ‘zoning out’ at the controls and one third of drivers reported having fallen asleep at the controls. Most drivers felt that fatigue was unavoidable. Drivers recognised fatigue through diminished reaction times and compromised situational awareness. Often, their recognition of fatigue was retrospective.

Discussion: We discuss the need to develop drivers’ prospective skills of fatigue recognition and pre-emptive action and suggest that this presents a target area for risk minimisation.

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Introduction

The workload of metropolitan train drivers involves more physical and cognitive demands than commonly acknowledged by the public.^{4,5} Shifts are often marked by intense peaks and troughs in cognitive workload. During peak and on busy lines, drivers need to decide when to open and close doors to allow passengers to board and alight. Even when assisted by cameras, drivers are anxious about trapping passengers in doors. During inter-peak periods, or on lines with few stops or crossings, drivers need to maintain attention despite a lack of stimulation from their work task. Regardless of time or line, every station that a driver encounters can remind a driver of the ever-present threat of fatalities or suicides.¹

Physically, drivers walk the length of trains when they change direction. They are also required to collect trains from yards, climb steep steps into cabins from track level and prepare trains (check that systems are working and re-set electrical systems if required). These tasks can occur more than once during a shift. Cognitive and physical tasks are required of drivers during night and day, wet and dry, and hot and cold. They are usually undertaken independently and always with the awareness that they are responsible for the safety of passengers, pedestrians and other road users at crossings. All the while, time and timetables are unavoidable pressures.^{3,6} It is not surprising that train drivers frequently report fatigue-related issues and that rail service providers invest in

fatigue risk management systems (FRMS) to mitigate the potential risks of fatigue.

Research on train driver workload and fatigue is characterised by quantitative measurement, through means such as actiwatches or workload and sleep diaries. This quantitative research provides important information about drivers sleep opportunity, duration and quality as well as time available for rest and recovery. It is also focussed primarily on task performance. However, quantitative assessments and evaluations tell us little about drivers' *in situ* experiences, perceptions and recognitions of fatigue. Therefore, the aim of the current paper is to present drivers' subjective perception and recognition of fatigue and identify implications of this understanding for FRMS. This is particularly important where drivers' recognition of fatigue is retrospective.

Methods

The present study employed a mixed-methods approach with a focus on qualitative research to elicit an insider's perspective on the impact of shift work on the experience and perception of fatigue. The research was conducted with metropolitan train drivers in an Australian capital city. Data collection tools were developed in association with driver representatives on the project steering committee and the research was approved by the University of South Australia's Human Research Ethics Committee. The research methods conform to the guidelines established by the National Health and Medical Research Council of Australia.

A closed-ended survey was completed by 124 drivers, of which 92.7% were male. It collected data on train drivers' self-perceptions of their quality of sleep in

general, the frequency of fatigue and falling asleep whilst working and travelling to and from work. The concept of fatigue was operationalised in two different ways: feeling sleepy and actually falling asleep. Driver representatives suggested that the phrase 'zoning out' would resonate more with drivers than feeling sleepy or fatigued, as zoning out was not necessarily considered a risk factor for falling asleep. Zoning out was clarified in surveys as the experience of a loss of attention which drivers might call 'zoning out'. As one driver explained:

- "It's not that you feel sleepy but you are aware that if something happened, you wouldn't be able to react quickly."

The surveys were analysed with descriptive statistics. Free-text comments from drivers informed the interpretation of the descriptive statistics as well as the design of the qualitative data collection tools.

To contextualise the survey data, ethnographic research was conducted using a variety of qualitative data collection techniques. Focus groups were conducted at each depot in the state, involving a total of 30 drivers. A further 5 drivers participated in one-on-one interviews. In-cab interviews were conducted with 13 train drivers to provide *in situ* data collection and participant-observation. One or two researchers accompanied drivers during part shifts. These in-cab interviews were conducted over a spread of days, times (peak and interpeak), lines and special services (such as additional services provided for a major football event). The authors also accompanied a driver through a full eight-hour shift (4am to 12pm). Qualitative data was analysed through thematic coding.

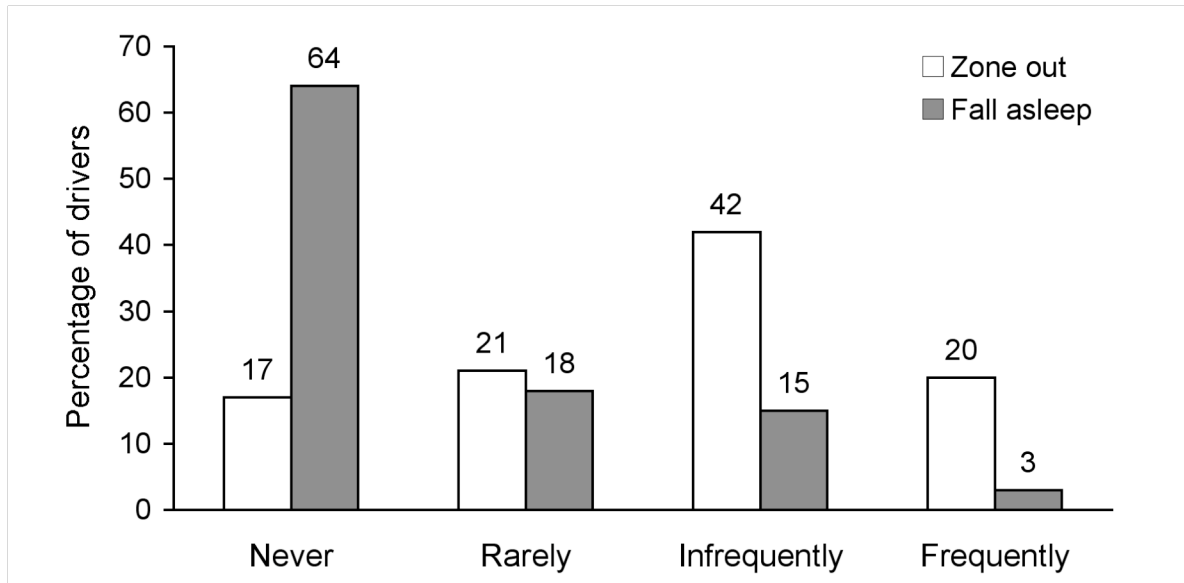


Figure 1. Drivers’ reported frequency of zoning out and falling asleep at the controls.

Results

The findings of our research presented in this paper refer to drivers’ experiences, perceptions and recognitions of fatigue.

Experiences of fatigue: “Drive a [rail] car all day and you’ll feel tired.”

Whilst some drivers reported never feeling tired during a shift, most drivers felt that fatigue was an inherent and unavoidable part of their work, if not life.

- “If we all gave in to fatigue the [transport organisation] couldn’t run. It’s just part of life to be tired.”

Many drivers reported fatigue in the form of ‘zoning out’ or ‘falling asleep’ at the controls. Zoning out was prevalent amongst drivers. Figure 1 shows that 83% of drivers have experienced zoning out whilst driving, while 17% reported to have never zoned out while at the controls. One in five drivers reported frequently zoning out at the controls.

In interviews and focus groups, drivers variously described zoning out as “feeling

sleepy”, “nodding off”, “being inattentive” and having slower reaction times. Zoning out was sometimes attributed to excessive cognitive demands. As one driver said,

- “You pass about 1200 signals per shift with passengers on top of that. It’s mentally fatiguing.”

However, zoning out was also attributed to underwhelming cognitive demands, especially in association with minimal physical demands or gear changing, such as when drivers worked lines characterised by long stretches with few level crossings or stations.

Whilst less common than zoning out, falling asleep is arguably more concerning. Just over one third of drivers surveyed could recall falling asleep at the controls. As one driver commented, “you wouldn’t find a driver here who hasn’t dozed off for a few seconds.” Whilst almost two thirds reported never falling asleep at the controls, 3% of the 124 drivers surveyed reported frequently falling asleep at the controls (figure 1).

Perceptions of fatigue: “just going through the motions”

Drivers perceived fatigue in similar terms as the indicators listed in the Code of Practice Working Hours,² including generic physiological cues such as eyes closing. Some drivers had identified personal physiological indicators:

- “My voice changes when I’m tired, when I talk to Train Control.”
- “I get dizzy spells when I get too tired.”

Drivers also reported compromised cognitive states arising from feeling fatigued:

- “You sometimes feel like if you had to react, you’d feel too slow or too late.”
- “When you’re tired out here it really does feel like you’re drunk.”

Unusual driving behaviours were cited by some drivers as indicative of fatigue:

- “Your breaking patterns change when you’re tired; it’s harder to pull up a loco.”
- “I’ll start to see shadows or blow the horn in weird places like at the 750 marker.”

Recognition of fatigue: “when you’re fatigued, you’re the last one to know.”

The ways in which drivers perceive their state as fatigued are largely embedded in the present. That is, “I must be tired/fatigued because...” However, drivers also talked about indicators which can be understood as retrospective means of recognising fatigue. They take the form of “I must have been tired/fatigued because...” For example, drivers frequently recalled times when they could not recollect their driving behaviours:

- “I arrived at [the end of the trip] and couldn’t remember acknowledging any signal along the way. I just couldn’t recall the trip in any way.”

- “Quite often you’ll be driving and think to yourself, ‘Did I stop at that last station?’ You can’t bring it back. You think ‘Geez I hope I did’.”
- “You’d stop and wonder if you’d missed a station and be waiting for Train Control to radio you to tell you that you had.”

In these cases of retrospective recognition of fatigue, drivers had little to no situational awareness of indicators that they were becoming fatigued, or did not, or were not able to respond to them. There has been little to no discussion of retrospective recognition of fatigue in the literature on train driving.

Discussion

The aim of the research was to identify drivers’ subjective experiences of fatigue to incorporate driver-recognised fatigue variables into a quantitative study. We asked each driver to explain how they knew that they were fatigued or tired. We expected drivers to list the standard fatigue indicators of yawning, heavy eyes, slow reaction times and so on. Whilst these factors suggest that fatigue has already started to impact on driving, we did not anticipate drivers reporting that they did not always recognise *in vivo* that they were fatigued. That is, it was often only in retrospect that they were left wondering if they had been fatigued. Their thoughts were prompted by an inability to remember their actions during a shift, such as stopping at a station. This may suggest that fatigue was impairing drivers’ ability to recognise fatigue. The occasions when drivers only recognised fatigue retrospectively raise significant safety concerns. If drivers are unaware of pending or present fatigue, they are unlikely to engage fully with FRMS strategies.

The prevalence of retrospective fatigue recognition, alongside the frequency of zoning out and falling asleep at the controls suggests the need for continuing improvement of FRMS to support the

safety of metropolitan railway operations. FRMS need to be sympathetic to the ways in which drivers develop personalised perceptions of fatigue and frequently recognise their fatigue retrospectively. In particular, we need to further develop drivers' prospective recognition of fatigue and encourage them to respond appropriately to fatigue. For example, drivers could be encouraged to identify the circumstances under which they are likely to retrospectively consider themselves fatigued. Based on this knowledge, they could further develop their personal FRMS systems to encourage *in vivo* recognition and response to fatigue (ie extending Level 3 FRMS Controls).

If we had collected data through the survey alone, we would not have identified drivers' retrospective recognition of fatigue. Rather, drivers shared their experiences of fatigue recognition through the conversational style adopted in focus groups. In particular, sharing cabs with drivers whilst they were on shift provided the *in situ* context through which drivers were prompted to discuss, and aided to recall, the times when they had passed a station and wondered if they had stopped when they were supposed to, or *vice versa*. Whilst ethnographic techniques are novel in risk and fatigue research with drivers, the value of incorporating an ethnographic component to our research was clear. Whilst many drivers felt that fatigue was simply "the nature of the beast", the real challenge is to ensure

that prospective recognition and preemptive action are the "culture of the beast".

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